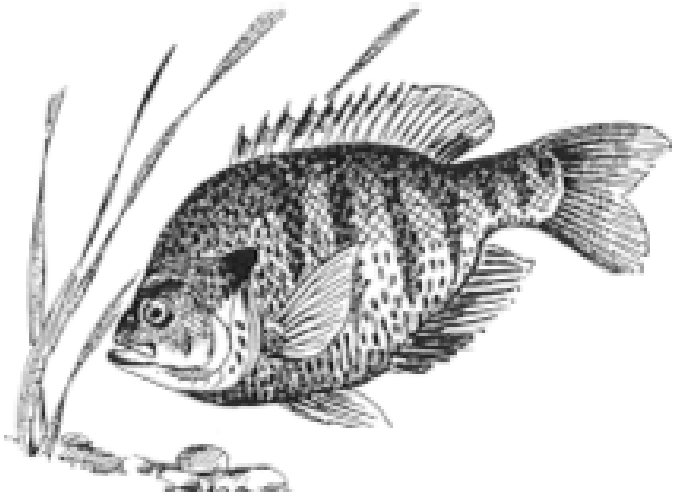
GLENN FLINT LAKE GIZZARD SHAD SELECTIVE

2004 Fish Management Report

J. Rhett Wisener
Assistant Fisheries Biologist



FISHERIES SECTION
INDIANA DEPARTMENT OF NATURAL RESOURCES
DIVISION OF FISH AND WILDLIFE
I.G.C. South, Room W273
402 W. Washington Street
Indianapolis, Indiana 46204

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Putnam County

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INTRODUCTION

Glenn Flint Lake is a 371-acre impoundment located about 6 miles northwest of Greencastle, Indiana. Little Walnut Creek Conservancy District owns the lake. The Indiana Department of Natural Resources, Division of Fish and Wildlife (DFW) manages the fishery at Glenn Flint.

A survey in 1993 found gizzard shad and carp causing major problems with the sport fishery at Glenn Flint (Keller 1994). Because of competition with shad, bluegill growth was suffering which led to a decrease in bluegill over 6 inches long. Survival of newly hatched bluegill and largemouth bass was poor because of competition with shad. As a result of fewer bass, carp increased in abundance as did their contribution to the problems with the sport fishery. To remedy the situation at Glenn Flint, a total eradication of the fishery was recommended.

In 1995, the fish in Glenn Flint and most of its watershed were eradicated using a fish toxicant called rotenone. The lake was restocked that same year with largemouth bass, bluegill, redear sunfish, and channel catfish. There were no shad or carp found during a survey of the lake in 1996 (Keller 1997). Findings from the survey showed the initial stockings were successful, therefore, black crappie were stocked later that year.

In 1998, bass and bluegill were found to be doing exceptionally well, however, six gizzard shad were collected in gill nets (Keller 1999). During spring bass sampling in 1999, it was evident that shad had spawned a large year class in 1998 (Keller 2000). The fishery changed quickly as shad abundance increased. By 2000, shad were again the most abundant species in the lake and they were already negatively impacting bass and bluegill recruitment (Wisener 2001). In 2002, an electrofishing only survey for shad, bluegill, and bass was conducted. In addition to the poor recruitment seen in 2000, bluegill were growing slightly slower than they were in 2000 (Keller 2003). If the shad population was left unchecked, the quality of the fishery at Glenn Flint would continue to decline and likely look much the same as it did prior to the renovation.

The best method to curb the problems that shad are causing at Glenn Flint would be to conduct another total renovation of the fishery. However, renovations are very expensive, time consuming, and the benefits are often short lived. Despite the best efforts of the DFW to eliminate shad from various reservoirs throughout the state, shad continue to reappear, and usually not because the renovations failed, but because they are illegally stocked.

DFW is exploring other options to manage shad populations and reduce competition between them and sportfish. At Glenn Flint this will be attempted with a series of selective gizzard

shad eradications. Shad are more sensitive to rotenone than other species at Glenn Flint. Therefore, shad can be specifically targeted with a low dosage of rotenone with relatively little effect on the rest of the fishery. The first gizzard shad selective eradication was conducted at Glenn Flint in 2004. Shad only sampling was conducted shortly before and after the selective to evaluate its effectiveness.

Gizzard shad, Largemouth bass, and Bluegill Sampling

One hour of D.C. electrofishing at night was conducted weekly from June 14 to 29. Total sampling effort was 3.0 hours (twelve, 15 minute stations) and approximately half of the shoreline was sampled. Only gizzard shad, largemouth bass, and bluegill were collected. All fish collected were measured to the nearest 0.1 inch and scale samples were taken for age and growth analysis. The primary purpose of the survey was to confirm the need for the selective eradication later that summer. Data collected in 2004 will be used for comparison in the future to determine if the bass and bluegill populations benefit from a series of gizzard shad selectives.

A total of 2,726 fish was collected in the survey. With 1,574 individuals collected, bluegill was the most abundant species sampled. Bluegill ranged in length from 1.4 to 7.3 inches and averaged 4.7 inches. As in 2002, just over 22% of the bluegill caught measured at least 6 inches, however, none of them were 8 inches or longer. The catch rate (524.7 per hour) and relative abundance of bluegill (57.7%) was the highest it has been since 2000 (Figures 1 and 2). With over 58% of the bluegill being ages 1 or 2, the 2002 and 2003 year classes accounted for the increased number of bluegill. Bluegill growth at Glenn Flint is normal compared to other central Indiana bluegill populations, however, growth of age 3 and older fish is still declining. At age 3, bluegill are just slightly smaller than they were in 2002, yet they are 0.8 inches smaller than those found in 2000. At age 4, bluegill are 0.7 inches shorter than those collected in 2002 and 0.9 inches smaller than those collected in 2000.

Bluegill PSD (proportional stock density) is the proportion of 3.0 inch and larger bluegill that are at least 6.0 inches long. As in 2002, bluegill PSD in 2004 was 23. Balanced fisheries generally have a bluegill PSD ranging from 20 to 40.

Gizzard shad up to 13.8 inches long were collected and on average they measured 8.3 inches. A total of 948 gizzard shad was collected. Shad accounted for 34.8% of the sample and were caught at the rate of 316 per hour. Both the catch rate and abundance of shad were much lower than in the two previous surveys. Newly developing shad populations expand rapidly. Often times more shad are produced in an expanding population than what a lake can support. As a result of competition, a shad die-off usually occurs and their abundance drops. This likely explains why shad abundance was much less in the recent survey. However, shad tend to rebound from those die-offs and gain in abundance.

Figure 1. Electrofishing catch rates of gizzard shad, bluegill, and largemouth bass at Glenn Flint Lake from 1993 to 2004

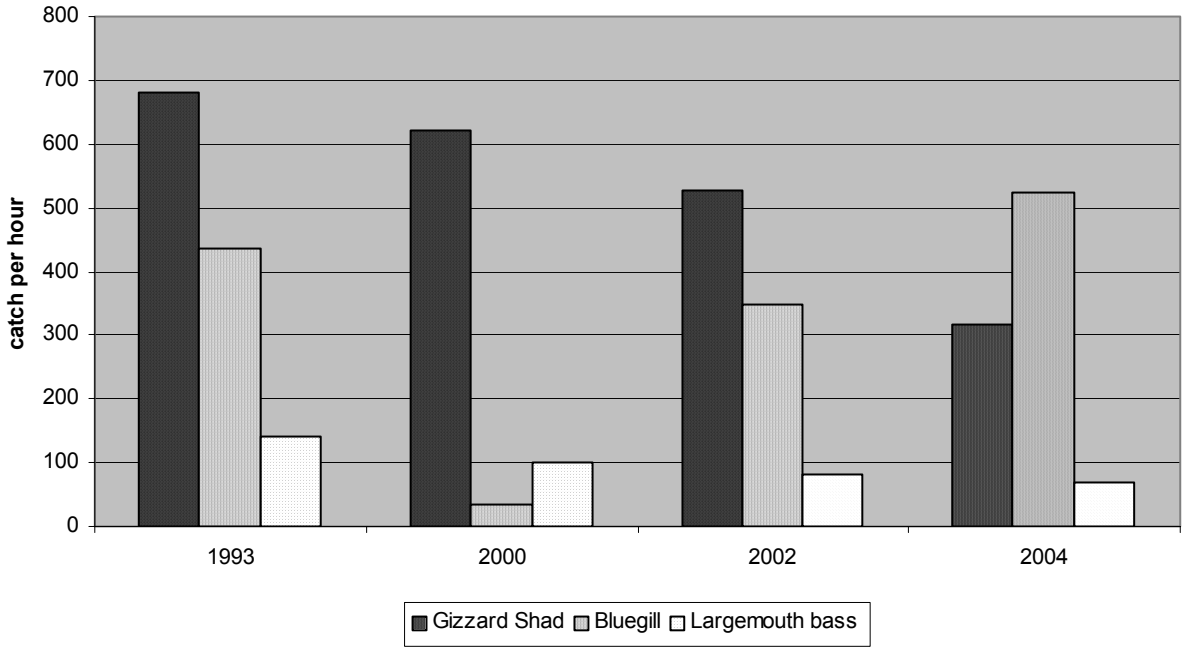
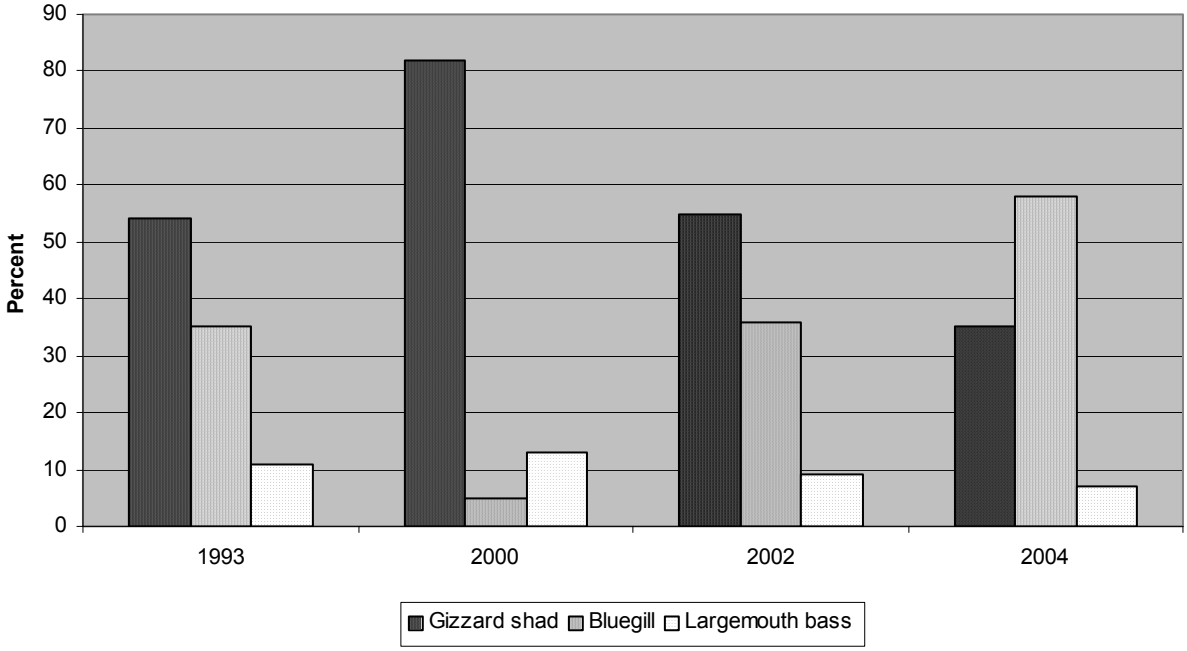


Figure 2. Relative abundance of gizzard shad, bluegill, and largemouth bass caught via electrofishing at Glenn Flint Lake from 1993 to 2004



Growth of shad caught in 2004 was much slower than in the two previous surveys and was slightly below the central Indiana average.

There were 204 largemouth bass collected. Largemouth bass were collected at the rate of 68 per hour. The catch rate of bass has been on the decline since 2000 (101 per hour) and was much lower in 2004 than it was in 1993 (143 per hour), the year it was decided to renovate the lake. Relative abundance of bass has nearly been cut in half since 2000, dropping from 13% to 7% in 2004. Although the number of bass is still declining, largemouth, like bluegill, took advantage of the drop in shad abundance as recruitment success was improved the past couple of years. Greater than 40% of the largemouth sampled were ages 1or 2 compared to just 11% in 2002. Nearly a quarter of the bass collected measured at least 14 inches long. The PSD for largemouth bass, which is the proportion of 8.0 inch and longer bass that are at least 12.0 inches long, was 60. Balanced fisheries usually have largemouth bass PSD's ranging from 40 to 60. Bass are growing near normal at Glenn Flint.

Although gizzard shad were much less abundant than in 2000 and 2002, they were still abundant enough to impact the fishery. Left alone, shad would likely increase in abundance as would their impacts on the rest of the fishery. Bluegill abundance was higher in 2004, but growth of age 3 and older bluegill has declined because of competition with shad. While largemouth have apparently experienced improved recruitment success the last couple of years, the catch rate of bass continues to decline. To hopefully increase the number of bluegill and bass and improve their growth, the gizzard shad selective scheduled for the late summer of 2004 was conducted.

Gizzard Shad Selective

On September 7, the drain at Glenn Flint was opened. Within a week the lake was drawn down approximately 5 feet and then the drain was closed. Drawing the lake down reduced the amount of rotenone needed and prevented any chemical from spilling out downstream of the lake and killing fish.

The selective eradication occurred on September 15. Four crews applied rotenone from boats with the use of boat bailers. The lake was divided into five treatment sections. Volume and average depth had been calculated for each section to determine the amount of chemical required to attain the maximum allowable concentration (0.13 ppm) for a selective eradication. Each section was treated in increments in order to gradually increase the concentration of rotenone and to try and avoid killing too many non-target species.

Small shad began responding immediately to the initial application of rotenone. Increasing numbers of shad appeared at the surface as the concentration of rotenone approached the target level. Treatments were halted in a section once large numbers of shad quit responding to an increased amount of rotenone and bigger shad had shown evidence of being affected. Also, if

many species other than shad began showing ill effects, treatment in that area was halted. Overall, 120 gallons of rotenone was applied and the concentrations within the different treatment sections ranged from approximately 0.10 to 0.13 ppm.

The day after the selective eradication, a mortality assessment was conducted to evaluate the impacts of the application. Ten random shoreline points that were scattered throughout the lake were sampled. At each locale, approximately the first 100 fish encountered while walking the shoreline were identified and recorded. Also, because a larger number of dead fish appeared to be floating on the lake, three transects were driven across the main body of the lake to identify and count fish. All fish were identified and counted along a transect until at least 100 shad had been observed.

Gizzard shad represented 71.1% of the fish washed up on shore (Table 1). The next most abundant group of fish found during shoreline sampling was sunfish (19.3%), which consisted of bluegill, longear and redear sunfish. Crappie and largemouth bass each accounted for less than 2% of the dead fish on shore. Only shad, sunfish, and yellow bass were observed during the open water counts. Shad was the dominant species found on the lake (86.8%) followed by sunfish (9.1%) and yellow bass (4.1%).

Table 1. Mortality assessment following the gizzard shad selective eradication at Glenn Flint Lake, September 16, 2004.

Area	Shad	Sunfish	Yellow bass	Crappie	Largemouth	Other	Total
Shoreline #	722	196	64	15	14	4	1,015
(10 stations)	71.1%	19.3%	6.3%	1.5%	1.4%	0.4%	
Open water #	315	33	15	0	0	0	363
(3 transects)	86.8%	9.1%	4.1%				
Combined #	1,037	229	79	15	14	4	1,378
	75.3%	16.6%	5.7%	1.1%	1.0%	0.3%	

Pre and Post Selective Shad Sampling

Targeted sampling for gizzard shad was conducted on August 31, a week before the drawdown started. Following the selective, shad sampling occurred on October 5. On each occasion, effort consisted of 1.0 hour of D.C. electrofishing at night. The four stations sampled and the electrofishing crew were the same on both dates. The purposes of the pre and post selective shad sampling were to judge how effective the selective was at reducing the shad population and if there was any size selectivity of shad killed.

During the pre-selective sampling, 513 shad were collected. Shad ranged in length from 5.6 to 14.3 inches and averaged 8.5 inches. In October, no shad were collected. There were no definite observations of shad that night either. Based on these results, it appears that the selective

eradication was successful at eliminating most of the shad in the lake. It also appears that the concentration of rotenone was adequate to target all sizes of shad.

CONCLUSIONS AND RECOMMENDATIONS

The selective eradication was very successful at reducing gizzard shad abundance. The reduction in shad was accomplished with little impact to non-target species other than possibly sunfish. However, bluegill abundance was higher than shad abundance in June, yet, bluegill and other sunfish mortality was far less than gizzard shad mortality. Although slightly more sunfish may have died than anticipated, less competition with shad should result in improved recruitment.

Through 2009, selective eradications will occur as needed at Glenn Flint to keep gizzard shad from reaching peak abundance. It is believed that selectives will need to be conducted every 2 to 3 years. In order to judge the need for a selective and how largemouth bass and bluegill populations respond to the reduced numbers of shad, annual sampling for shad, bass, and bluegill will be conducted. If bass and bluegill respond as anticipated, improved catch rates of both, improved growth of bluegill, and an increase in the number of 6 inch and larger bluegill is expected. To sustain those improvements, shad abundance will need to remain low. Since shad abundance can increase quickly, preparations will be made to conduct the next selective in the late summer of 2006. Sampling in June of 2006 will indicate whether or not to proceed with the selective.

Following the selective, there was a large void created in the biomass at Glenn Flint. Any shad remaining in the lake can reclaim much of that biomass with a good spawn in 2005. Predator stockings need to follow up selective eradications to help fill that void and to increase the amount of predation on shad. Due to extreme demand for bass from state hatcheries in 2004, Glenn Flint was not stocked in the fall with 18,550 (50 per acre) largemouth fingerlings as requested. Instead, just 619 bass that averaged 7 inches long were stocked. To help make up for the shortage of bass stocked in 2004, fingerlings should be stocked in the fall of 2005 at the rate of 30 per acre or 11,130 total. Preferably, if hatcheries have any surplus largemouth bass available in the spring of 2005 they should be stocked at Glenn Flint.

Assuming that gizzard shad were not eliminated from the lake, an additional predator species could be supported at Glenn Flint. The purpose of stocking another predator would be to increase angling opportunities and to increase predation on shad. Two species that readily prey on shad and are options for stocking at Glenn Flint are hybrid striped bass and muskellunge. There would be benefits to stocking each. Hybrid stripers are pelagic and roam the open water in pursuit of shad, whereas muskie relate to weed and wood cover and wait for prey to come to them. Stocking rates for hybrids would be greater than for muskie. If stockings of both species were successful, a more dense predator population could result from stocking hybrids rather than muskie. However, in the last few years state hatchery production of muskie has been more consistent than hybrid striper production. Therefore, muskie are more apt to be available on an

annual basis.

There is concern about stocking hybrids in lakes where there are white bass. White bass genetics may be compromised by stocking hybrid striped bass because of the potential for crossbreeding. While no white bass were found during the last community evaluation in 2000, it is believed that some have been observed while conducting shad, bass, and bluegill sampling since then. If there was no concern about white bass genetics, hybrid striped bass would be the preferred species to stock because they could likely exert a greater amount of predatory pressure on shad than muskie.

Until more is known about white bass at Glenn Flint, it is recommended that muskie be stocked. Beginning in the fall of 2005, Glenn Flint should be annually stocked with 1,855 (5 per acre) forage-finished muskie. Surveys targeting muskie survival and growth will be performed. If muskie stockings fail or it is found that there is not a significant white bass population, then hybrid striped bass could be stocked.

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Date: February 18, 2005

Approved by: _____
Brian M. Schoenung, Fisheries Supervisor
Date: May 3, 2005

NUMBER, PERCENTAGE, WEIGHT, AND AGE OF BLUEGILL (June sampling)									
TOTAL LENGTH (inches)	NUMBER COLLECTED	PERCENT OF FISH COLLECTED	EST. AVG. WEIGHT (pounds)	AGE OF FISH	TOTAL LENGTH (inches)	NUMBER COLLECTED	PERCENT OF FISH COLLECTED	EST. AVG. WEIGHT (pounds)	AGE OF FISH
1.0					19.0				
1.5	3	0.2	0.01	1	19.5				
2.0	6	0.4	0.01	1	20.0				
2.5	79	5.0	0.01	1	20.5				
3.0	94	6.0	0.02	1	21.0				
3.5	125	7.9	0.03	1,2	21.5				
4.0	349	22.2	0.04	2	22.0				
4.5	263	16.7	0.06	2	22.5				
5.0	106	6.7	0.08	2,3,4	23.0				
5.5	194	12.3	0.11	3,4	23.5				
6.0	165	10.5	0.15	3,4	24.0				
6.5	137	8.7	0.20	3,4	24.5				
7.0	44	2.8	0.25	4	25.0				
7.5	9	0.6	0.31	5	25.5				
8.0					26.0				
8.5					TOTAL	1574			
9.0									
9.5									
10.0									
10.5									
11.0									
11.5									
12.0									
12.5									
13.0									
13.5									
14.0									
14.5									
15.0									
15.5									
16.0									
16.5									
17.0									
17.5									
18.0									
18.5									

ELECTROFISHING CATCH	524.7/hr	GILL NET CATCH	NA	TRAP NET CATCH	NA

NUMBER, PERCENTAGE, WEIGHT, AND AGE OF GIZZARD SHAD (June sampling)									
TOTAL LENGTH (inches)	NUMBER COLLECTED	PERCENT OF FISH COLLECTED	EST. AVG. WEIGHT (pounds)	AGE OF FISH	TOTAL LENGTH (inches)	NUMBER COLLECTED	PERCENT OF FISH COLLECTED	EST. AVG. WEIGHT (pounds)	AGE OF FISH
1.0					19.0				
1.5	5	0.5	<0.01	0	19.5				
2.0	4	0.4	0.01	0	20.0				
2.5	1	0.1	0.01	0	20.5				
3.0					21.0				
3.5					21.5				
4.0					22.0				
4.5					22.5				
5.0					23.0				
5.5					23.5				
6.0	4	0.4	0.07	1	24.0				
6.5	74	7.8	0.09	1	24.5				
7.0	90	9.5	0.11	1	25.0				
7.5	166	17.5	0.14	1,2	25.5				
8.0	202	21.3	0.17	2	26.0				
8.5	183	19.3	0.21	2,3	TOTAL	948			
9.0	74	7.8	0.24	3					
9.5	21	2.2	0.29	3					
10.0	9	0.9	0.34	3,4					
10.5	11	1.2	0.39	not aged					
11.0	28	3.0	0.45	not aged					
11.5	26	2.7	0.52	not aged					
12.0	23	2.4	0.58	not aged					
12.5	15	1.6	0.69	not aged					
13.0	6	0.6	0.80	not aged					
13.5	4	0.4	0.91	not aged					
14.0	2	0.2	0.97	not aged					
14.5									
15.0									
15.5									
16.0									
16.5									
17.0									
17.5									
18.0									
18.5									

ELECTROFISHING CATCH	316.0/hr	GILL NET CATCH	NA	TRAP NET CATCH	NA

NUMBER, PERCENTAGE, WEIGHT, AND AGE OF LARGEMOUTH BASS (June sampling)									
TOTAL LENGTH (inches)	NUMBER COLLECTED	PERCENT OF FISH COLLECTED	EST. AVG. WEIGHT (pounds)	AGE OF FISH	TOTAL LENGTH (inches)	NUMBER COLLECTED	PERCENT OF FISH COLLECTED	EST. AVG. WEIGHT (pounds)	AGE OF FISH
1.0					19.0				
1.5	5	2.5	<0.01	0	19.5	1	0.5	4.19	not aged
2.0	12	5.9	0.01	0	20.0				
2.5	14	6.9	0.01	0	20.5				
3.0	6	2.9	0.01	0	21.0				
3.5					21.5				
4.0	3	1.5	0.03	1	22.0				
4.5	4	2.0	0.04	1	22.5				
5.0	12	5.9	0.05	1	23.0				
5.5	12	5.9	0.07	1	23.5				
6.0	13	6.4	0.09	1	24.0				
6.5	6	2.9	0.12	1	24.5				
7.0	2	1.0	0.15	1	25.0				
7.5	4	2.0	0.19	1,2	25.5				
8.0	1	0.5	0.23	1	26.0				
8.5	2	1.0	0.28	2	TOTAL	204			
9.0	4	2.0	0.33	2					
9.5	10	4.9	0.40	2					
10.0	10	4.9	0.46	2,3					
10.5	6	2.9	0.54	2					
11.0	7	3.4	0.63	2,3					
11.5	4	2.0	0.72	2,3,4					
12.0	7	3.4	0.82	2,3,4					
12.5	3	1.5	0.95	2,3					
13.0	6	2.9	1.08	2,3,4,5					
13.5	2	1.0	1.20	2,5					
14.0	5	2.5	1.38	4,5					
14.5	8	3.9	1.56	3,4,6					
15.0	10	4.9	1.74	3,4,5,6					
15.5	3	1.5	1.92	5					
16.0	7	3.4	2.15	6					
16.5	3	1.5	2.36	not aged					
17.0	2	1.0	2.62	not aged					
17.5	2	1.0	2.84	not aged					
18.0	7	3.4	3.18	not aged					
18.5	1	0.5	3.54	not aged					

ELECTROFISHING CATCH	68.0/hr	GILL NET CATCH	NA	TRAP NET CATCH	NA

NUMBER, PERCENTAGE, WEIGHT, AND AGE OF GIZZARD SHAD (August pre-selective sampling)									
TOTAL LENGTH (inches)	NUMBER COLLECTED	PERCENT OF FISH COLLECTED	EST. AVG. WEIGHT (pounds)	AGE OF FISH	TOTAL LENGTH (inches)	NUMBER COLLECTED	PERCENT OF FISH COLLECTED	EST. AVG. WEIGHT (pounds)	AGE OF FISH
1.0					19.0				
1.5					19.5				
2.0					20.0				
2.5					20.5				
3.0					21.0				
3.5					21.5				
4.0					22.0				
4.5					22.5				
5.0					23.0				
5.5	3	0.6	0.05	not aged	23.5				
6.0	41	8.0	0.07	not aged	24.0				
6.5	19	3.7	0.09	not aged	24.5				
7.0	28	5.5	0.11	not aged	25.0				
7.5	43	8.4	0.14	not aged	25.5				
8.0	88	17.2	0.17	not aged	26.0				
8.5	108	21.1	0.21	not aged	TOTAL	513			
9.0	77	15.0	0.24	not aged					
9.5	34	6.6	0.29	not aged					
10.0	21	4.1	0.34	not aged					
10.5	10	1.9	0.39	not aged					
11.0	12	2.3	0.45	not aged					
11.5	5	1.0	0.52	not aged					
12.0	5	1.0	0.58	not aged					
12.5	9	1.8	0.69	not aged					
13.0	7	1.4	0.80	not aged					
13.5	2	0.4	0.91	not aged					
14.0									
14.5	1	0.2	1.01	not aged					
15.0									
15.5									
16.0									
16.5									
17.0									
17.5									
18.0									
18.5									

ELECTROFISHING CATCH	513.0/hr	GILL NET CATCH	NA	TRAP NET CATCH	NA

Species Bluegill	YEAR CLASS	NUMBER OF FISH AGED	SIZE RANGE	BACK CALCULATED LENGTH (inches) AT EACH AGE							
				I	II	III	IV	V	VI	VII	VIII
Intercept= 0.8 in.	2003	13	2.1-3.3	2.0							
	2002	17	3.4-5.0	1.9	3.5						
	2001	7	5.2-6.4	1.6	3.6	5.5					
	2000	14	5.1-7.2	1.5	3.5	5.0	6.0				
	1999	1*	7.3	1.4	2.7	5.5	6.6	7.2			
	AVERAGE LENGTH			1.8	3.5	5.2	6.0				
	NUMBER AGED			51	38	21	14				

Species Gizzard shad	YEAR CLASS	NUMBER OF FISH AGED	SIZE RANGE	BACK CALCULATED LENGTH (inches) AT EACH AGE							
				I	II	III	IV	V	VI	VII	VIII
Intercept= 0.0 in.	2003	14	6.0-7.4	6.3							
	2002	11	7.5-8.6	3.9	6.9						
	2001	11	8.4-9.8	4.2	7.1	8.2					
	2000	2*	9.9-10.1	4.7	7.2	8.4	9.6				
	AVERAGE LENGTH			4.8	7.0	8.2					
	NUMBER AGED			36	22	11					

Species Largemouth bass	YEAR CLASS	NUMBER OF FISH AGED	SIZE RANGE	BACK CALCULATED LENGTH (inches) AT EACH AGE							
				I	II	III	IV	V	VI	VII	VIII
Intercept= 0.8 in.	2003	28	4.1-7.8	4.2							
	2002	27	7.5-13.5	5.1	9.4						
	2001	12	9.9-14.9	4.7	9.4	11.9					
	2000	11	11.6-15.2	5.1	8.6	11.2	13.0				
	1999	7	13.1-15.5	4.7	8.0	10.1	12.2	14.1			
	1998	4	14.7-16.0	5.4	8.6	10.6	12.1	13.2	14.9		
	AVERAGE LENGTH			4.9	8.8	10.9	12.4	13.6	14.9		
	NUMBER AGED			89	61	34	22	11	4		